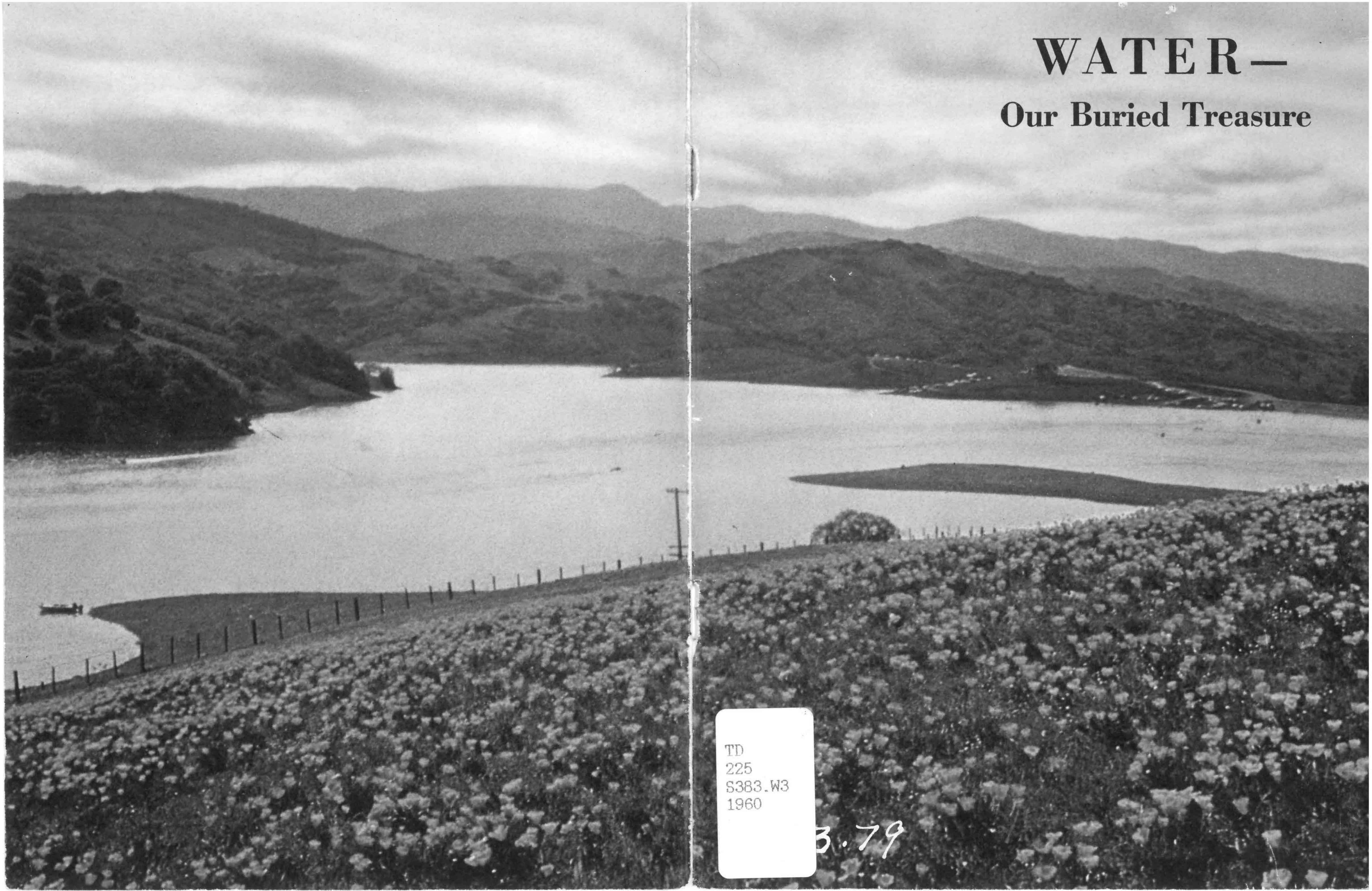
WATER—

Our Buried Treasure



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Water:
Our Buried Treasure

THE STORY OF WATER CONSERVATION IN THE SANTA CLARA VALLEY

A Cooperative Project of the Santa Clara County
School Department and the Santa Clara Valley
Water Conservation District

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Our Buried Treasure

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Early Santa Clara Valley Days

Water is as important as the air we breathe, the sun that shines, the very ground on which we walk. Since the beginning of time, water has shaped the history of the world. Water has played a large and important role in the development of the Santa Clara Valley.

Let's turn back the clock to the early days of the Santa Clara Valley and see how water has affected the progress that has changed our valley from a sleepy cattle ranching area to an important industrial and agricultural center. When the flags of Spain and Mexico flew over California, the Santa Clara Valley was one of the most important cattle raising centers in the territory. A hundred years ago the Mission at Santa Clara owned over 150,000 head of livestock, mainly cattle and sheep. At Joaquin Bernal's Santa Teresa Rancho, about eight miles south of San Jose, 5,000 head of calves were branded every year.

The discovery of gold in California and the coming of the Americans changed this picture almost completely. The vast ranchos with their large herds of livestock soon began to disappear. In a few years practically the entire Santa Clara Valley was devoted to raising grain. There were ten flour mills scattered across the valley from Alviso to Gilroy. Huge combine harvesters, drawn by teams of twenty horses, were used in the fields. As late as 1900, farmers were operating a threshing machine on land near the present Herbert Hoover Junior High School on Park Avenue in San Jose.

Neither the raising of cattle nor the fields of grain required water for irrigation. Both of these activities depended solely on dry farming.

In 1856 Pierre Pellier, a French agriculturist, discovered that the soil here was ideal for raising French prunes. This discovery changed the entire face of the valley in less than fifty years! Within twenty years dried prunes became nationally

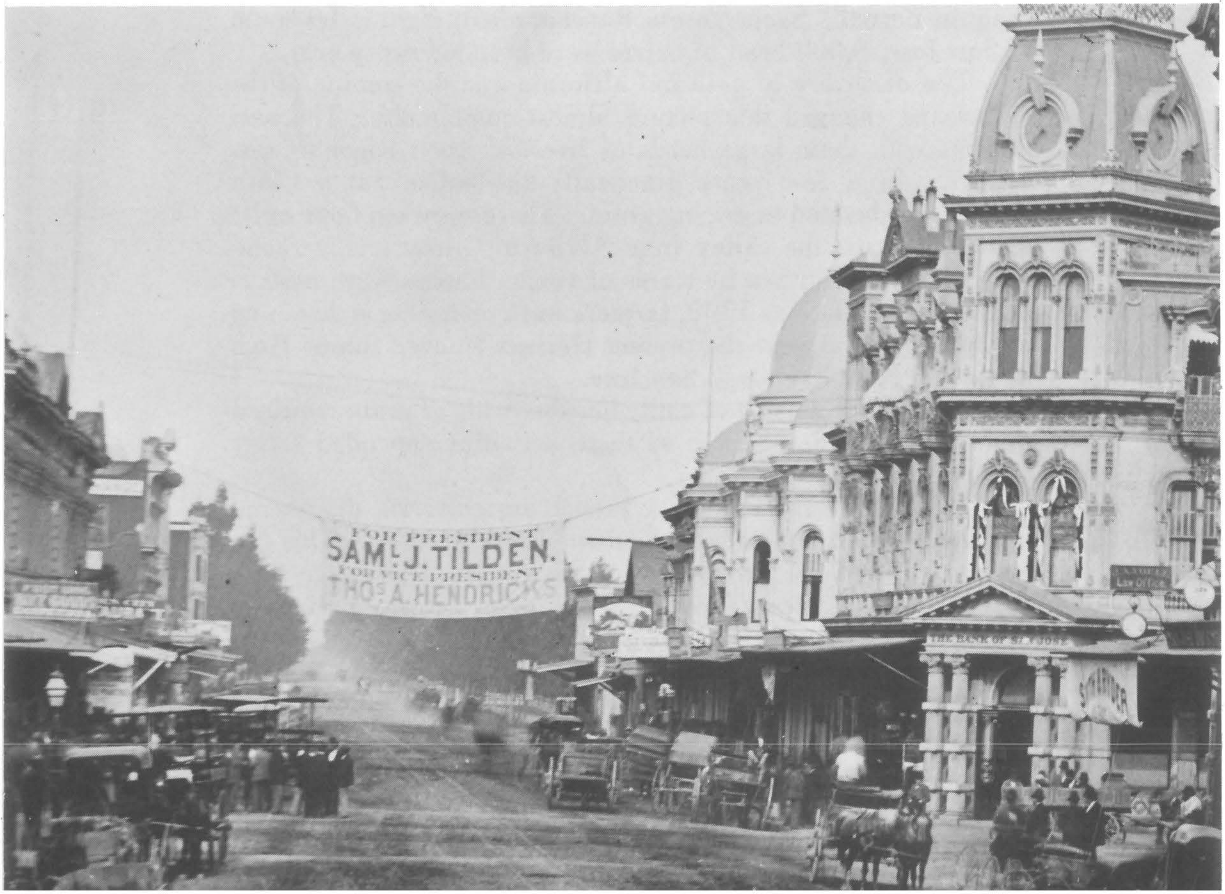
South First Street, San Jose, 1876

popular and Santa Clara Valley farmers planted prune orchards in place of grain fields. Huge quantities of prunes were sent to eastern markets and shipping ports by transcontinental railway.

These orchards, unlike the grain fields, required water which seemed at the time to be plentiful. The valley was dotted with hundreds of ponds, and ditches carried steady streams of water along most of the country roads. In the heart of San Jose, next to First and Santa Clara Streets, an artesian well flowed constantly. This is where the street "Fountain Alley" gained its name. The most popular recreation on a warm sunny day was boating on the large lake less than a half-mile from the present down-town San Jose business district!

An area with many full creeks, steadily flowing artesian wells and "ponds that have no bottom" gave no indication of future water problems!

First and Santa Clara Streets, 1876



Artesian Well

The Need for Conservation

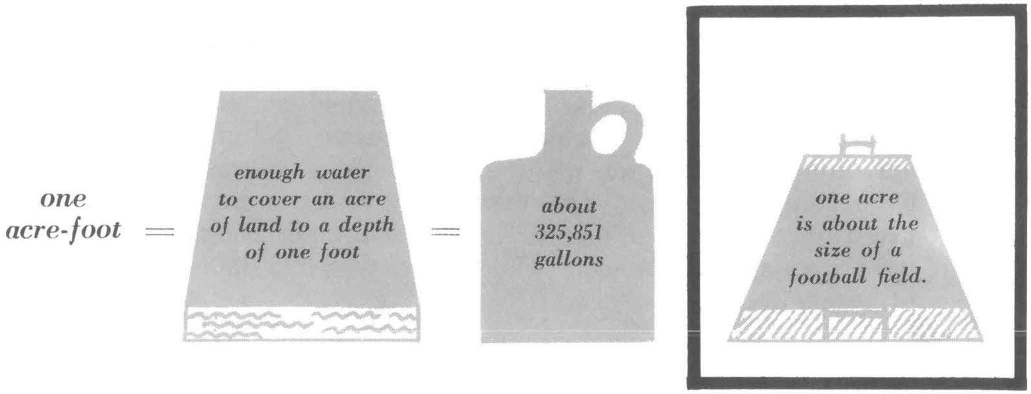
At the turn of the century there was a surplus of fresh water available in Santa Clara Valley for almost every need. Farmers began putting more and more land into orchards but paid little attention to irrigation. The *ground water level* (the distance at which water is reached below the ground) was so high that when wells were drilled, water flowed without pumping. The underground water pressure was great enough to force the water out at the surface, creating an artesian well. Heavy winter rains provided sufficient water to take care of crop needs. A few people warned against the waste of water from the steadily flowing artesian wells which were common in the valley. Unfortunately, these protests were seldom heeded.

The water supply picture began to change when the valley suffered a succession of dry years. To save the orchards, wells with pumps were installed. These were continued in use when it was noticed that regular irrigation resulted in better crop yields. By 1915, the combination of domestic, industrial and agricultural pumping was taking 25,000 acre-feet of water from the ground every year. One acre-foot of water is the amount necessary to cover one acre of land (about eight average city lots) to a depth of one foot. This is more than 325,800 gallons of water.

Meanwhile, the valley was slowly growing. More people were settling here; industry was expanding; and new, improved farming methods were increasing agricultural production. These growth conditions caused a marked increase in the use of water. The cost of pumping water began to rise because wells had to be driven deeper into the ground to reach water. More money was needed to deepen old wells and install new ones. Larger pumping plants were required to operate these deep wells. More power was needed to run pumps as the *lift* (the distance water is raised from the underground) increased. The water level was falling rapidly.

It is easy to see why the underground water level began to drop during this period. In 1892 there were only 100 wells in the entire valley; by 1920 there were 1700 wells! The total area under irrigation was also increasing. Back in 1912, about 29 percent of the land was irrigated and by 1920 this had risen to more than 67 percent. The amount of land irrigated by the "ditch" method (diverting water from nearby streams into ditches for the fields and orchards) decreased. In 1900 about 13,000 acres were being irrigated by this ditch method; by 1920 only 3,000 acres of land were irrigated in this manner. All of the remaining orchards and farm lands in the valley were irrigated with water pumped from the underground.

The people whose farms and orchards depended upon well water became deeply concerned over the future of their water supply. In 1916 the average well would reach water at about 24 feet below ground level. By 1920 wells had to be drilled to 54 feet below ground level, on the average, to reach water. This is a drop of 30 feet in only four years!

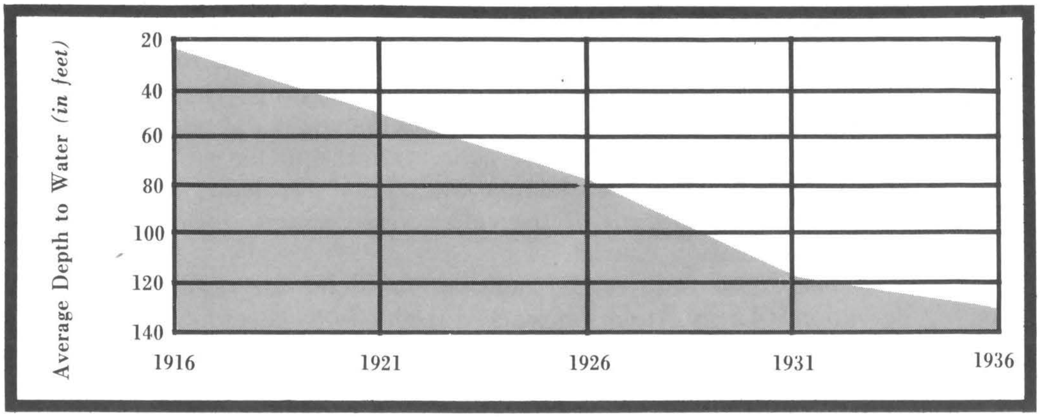

one acre-foot
=
enough water to cover an acre of land to a depth of one foot
=
about 325,851 gallons
one acre is about the size of a football field.

Several years later, in 1933, geologists noticed that slowly but surely the valley floor was sinking! An area of almost 200 square miles—from Redwood City to Coyote and across the valley at its widest point from Los Gatos to Alum Rock—was sinking as the underground water level fell. This sinking, called *land subsidence* by engineers, can have damaging effect on storm sewers and sanitary systems because these lines lose their original grade and soon become obsolete.

By now, people of the valley had become alarmed when they realized that more water was being taken from the underground each year than nature could return through the winter rains. About 62 per cent of the rain water coursed down the valley streams to the San Francisco Bay—where it was lost. It was obvious that unless some action were taken to conserve the dwindling water supply, a succession of dry years would completely ruin the valley.

The Beginning and Development of the Water Conservation Program

The first attempt to develop a water conservation program was made in 1913. Two dry seasons had parched the valley and the farmers and ranchers were deeply concerned. They met at Campbell and attempted to secure Federal aid for irrigation projects. They learned that Federal money was at that time available only for "arid and semi-arid" areas and Santa Clara Valley did not meet this requirement, so plans for a conservation program were abandoned.



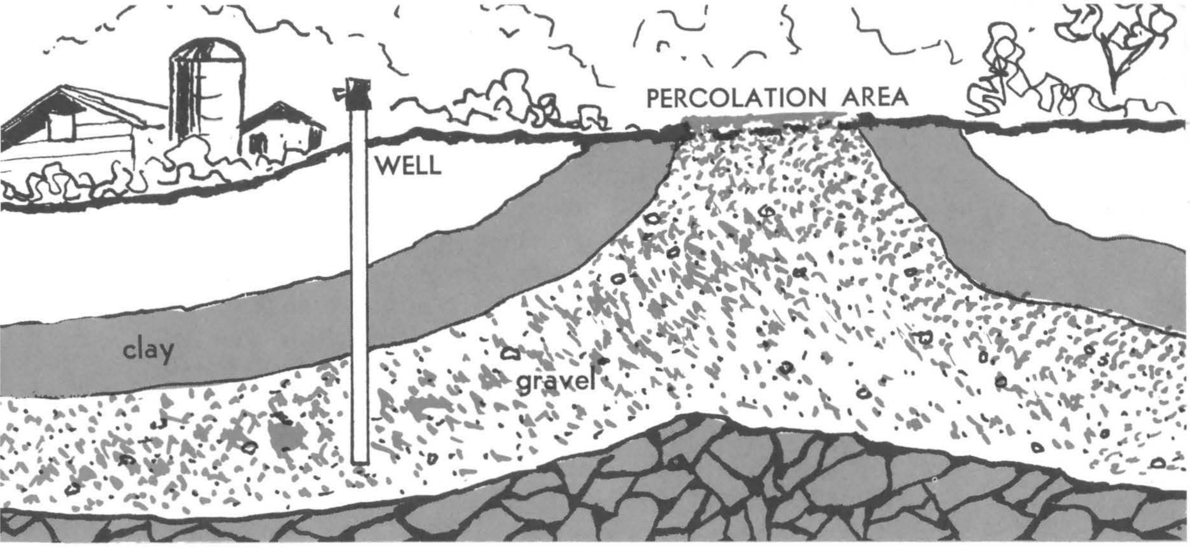
Falling Water Level: 1916-36

Storm Water Flowing to the Bay

After World War I the demands for water increased and interested citizens again met and attempted to solve the growing water problem. They agreed that the situation would be improved if they could find a way to save the 62 percent of the winter rain water which flowed into the San Francisco Bay. From 1921 to 1925 Leroy Anderson, State Senator Herbert C. Jones, L. D. Bohnett, and other far-sighted citizens led the battle to save our water by forming a water conservation district.

Fred H. Tibbetts and Stephen E. Kieffer, prominent San Francisco engineers, studied the water situation in the valley and made recommendations for water conservation. Their report covered every phase of the water problem and is still used as a guide for action. They recommended construction of a complete system of dams, canals, percolation beds, and other projects. To pay for these new facilities, they suggested that a water conservation district be formed. This district, when created by the voters at an election, would have the power to raise money for the necessary facilities by taxing the property owners in the district. An election was held, but the voters did not fully understand the need for water conservation and the proposal was defeated. Another election was called for later, and a second time the citizens of the valley voted against forming a water conservation district.

These two failures did not stop the drive for water conservation. Leroy Anderson worked tirelessly to develop public



How Percolation Works

understanding and create interest in the need for a water conservation program. He called conferences of farm and agricultural groups, spoke at community gatherings, solicited funds from his friends, begged and borrowed supplies. He believed that the best way to influence people favorably toward conservation was to show that conservation worked. He believed that this could be done by *percolation,* a method which allows surface water to filter through to the underground.

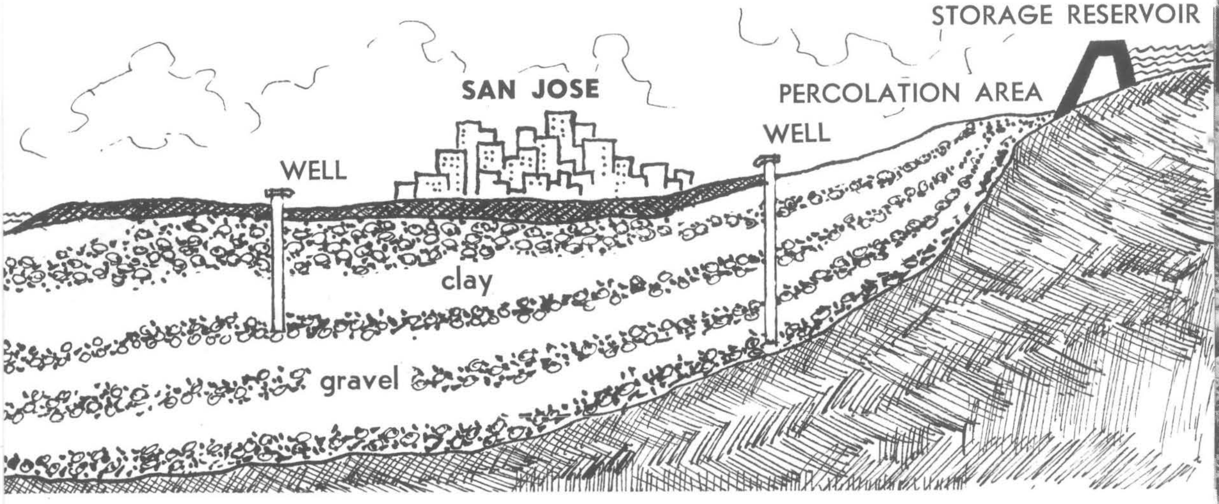
The word "percolate" comes from the Latin: *per* meaning through, and *colo* meaning filter. Percolating means *filtering through.* That's what happens in the type of coffee pot called a "percolator"; the hot water filters down through the ground coffee. Anderson's percolation idea involved the filtering or passing of water through some substance to the underground.

Let's take a look at the Santa Clara Valley underground. Many people believe that our underground water supply is actually a large lake or river far below the earth's surface. This is not true. The earth is made up of many *strata* or layers of rock, gravel, sand, dirt, and clay. Some of these strata are interlocking layers of sand and gravel, often the channels of ancient streams. These networks of gravel and sand are called *aquifers* (water bearing) because they are capable of holding water in the spaces between the particles of sand and gravel. Almost all of the water used in our valley comes from wells which tap this water stored in the underground aquifers.

These aquifers make up a vast underground storage reservoir for our valley, an invaluable natural resource. Hydrologists (engineers who deal with the waters of the earth) have estimated the capacity of this underground storage at 1,771,000 acre-feet between the 25 and 300 foot depth levels! It would require 23 reservoirs as large as the Leroy Anderson reservoir to hold this supply! This means there is water storage of 6,440 acre-feet for each foot of depth. Geologists believe that an underground clay barrier effectively blocks the flow of salt water from the San Francisco Bay into this underground fresh water storage, thus protecting the underground water supply in our area from salt water contamination.

Throughout most of the valley, the underground gravel layers are also sealed off from the surface by an impervious clay blanket; however, in certain places the gravel layers reach the surface and connect with existing stream beds or other areas. At these locations, water can filter down or percolate into the underground aquifers. This is the basis for Anderson's percolation program. By spreading water over a percolation area, a steady rate of flow into the underground aquifers can be maintained.

Anderson's early work in conservation was devoted to practical projects to demonstrate the percolation program. By building low dams of earth-filled sacks across stream beds, water was backed up and spread across a greater area of stream gravel to intensify the normal percolation or filtering activity that carries water to the underground. Several of these tem-



Cross-section of Underground

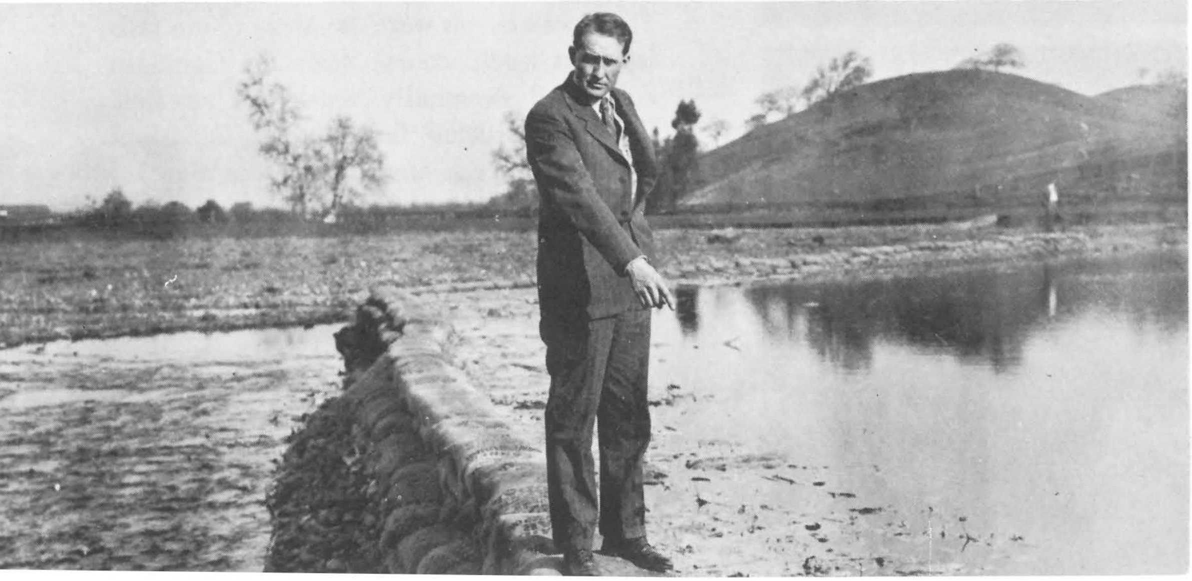
porary dams were constructed in the west valley area during the winter of 1926-27. The gravel area behind these dams was thoroughly cleaned by scraping away the silt in order to aid the percolation process.

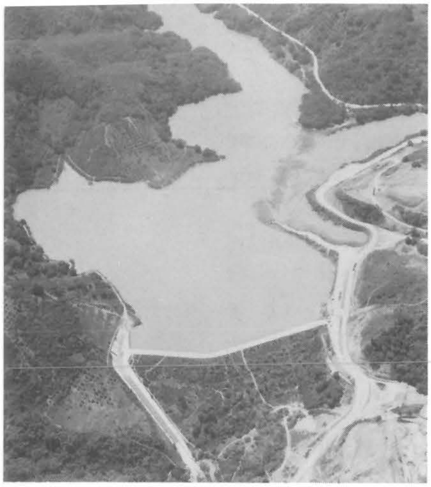
This practical experiment was successful. Wells on nearby farms were measured periodically and results showed higher water levels than at any time during the past five years. These increases had occurred before the heavy winter rains and therefore were considered to be caused by Anderson's percolation system.

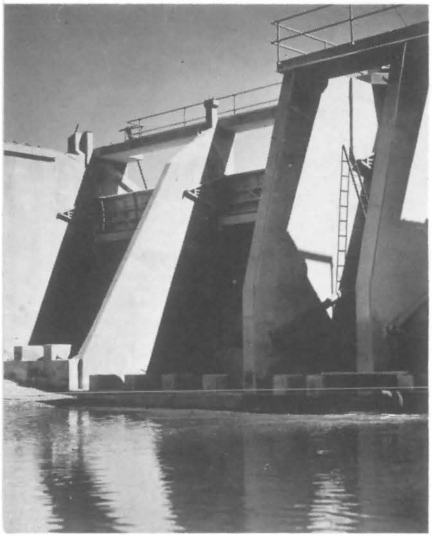
The favorable results of the percolation experiment helped Anderson to obtain more funds to expand his work. A Valley Water Conservation Association was formed and provided additional money for the percolation project. Activity in this area continued and further improvements were made in the west valley on the Guadalupe River and Los Gatos Creek.

Meanwhile, the general water level throughout the valley continued to fall. By 1929, the average depth to water was over 100 feet and there was no indication that this downward trend would stop. Because of these serious conditions and the success of Leroy Anderson's work on percolation, a third election was held to form the Santa Clara Valley Water Conservation District. The District would extend north to San Antonio Creek north of Mountain View, east and west to the foothills, and south to Coyote. On November 12, 1929, the voters approved the proposal by a margin of almost nine to one!

Early Sack Dam







The new Water Conservation District was now ready to go to work. The percolation program that Leroy Anderson had started and carried on in the west valley was quite limited. It operated only during the winter months when the streams were flowing, and the small "sack" dams could hold back only a small portion of the total stream flow. These small dams were often washed out when streams were swollen by heavy winter rains or flash storms. There was still a great deal of water running into the bay.

Leroy Anderson had proved that percolation would raise the underground water level. But how could we percolate more of the winter run-off and reduce the amount of water lost by flowing into the bay? If this run-off could be captured and stored behind large dams, later it could be released slowly and delivered to areas prepared to percolate the water to the underground reservoir.

Engineers investigated the local water problem, studied the entire Santa Clara Valley and selected the main watersheds. These watersheds were the areas where falling rain would course down the mountain sides and eventually reach the streams. Dams constructed in the most important watershed areas would stop the flow of water to the sea. The water would be backed up to form a reservoir where it could be stored until needed. After the rainy season, enough water could be re-

Stevens Creek Reservoir

Almaden Reservoir

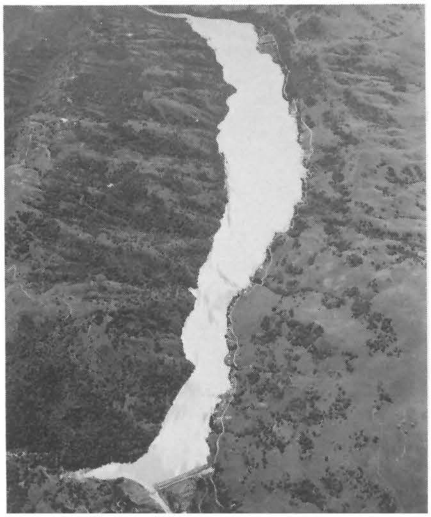
Vasona Dam

leased to flow into the streams and through canals to percolation areas.

When the engineers submitted their reports, they included recommendations for the location of a number of dams with estimates of the cost of construction. The public voted in June 1934 to approve a $2,000,000 bond issue to finance part of this construction program. A local citizens' committee headed by John D. Crummey obtained Federal assistance for one-fourth of the cost. By 1936 the first six conservation dams were completed: Vasona, Almaden, Guadalupe, Stevens Creek, Calero and Coyote. These reservoirs began to capture and store the winter rains, and none too soon—the average depth to water had now dropped to 131 feet. Twenty years before, the average depth to water was 24 feet!

The effect of these new conservation facilities was noticed almost immediately. Although the rainfall that winter was about the same as usual, the underground water level rose an average of almost 13 feet. In some places near the percolation works, wells showed that the water table had risen as much as 100 feet!

Water stored in the reservoirs was released gradually throughout the dry summer to the percolation areas. There it seeped down into the aquifer network, and even though the farmers carried on their normal summer irrigation pumping, the underground water levels held firm! The underground water storage system was being effectively re-supplied.



Guadalupe Reservoir
Calero Reservoir
Coyote Reservoir

Construction of Lexington Dam

Water Needs Increase

The underground water level rose steadily after the six new dams were placed in operation. By 1943 the average "depth to water" had returned to the 1923 level of approximately 56 feet. The next year, however, the underground water level dropped again!

The Santa Clara Valley had grown steadily and the use of water, particularly during the years of World War II, had increased far beyond the normal annual supply. Hundreds of new families were moving into the valley as industries were expanded and important branches of large corporations built plants and offices here. Farmers worked the land on a year-round basis, raising crops to meet the greater requirements for food. All of these factors plus a series of dry years with little winter rain meant that the water replacement program, although working well, could not keep up with the greater needs.

The Lexington Dam

Planning for more water storage on the west side of the valley had been underway for some time. In 1933 a dam and reservoir was proposed for Los Gatos Creek south of the town of Los Gatos. However, the Southern Pacific Railroad operated daily train service from San Jose through Los Gatos to Santa Cruz, and the railway line ran along the Los Gatos Creek through the proposed reservoir site. Since there seemed to be no way of moving the railroad, there appeared to be little hope for a conservation project there.

The situation changed later when the highway to Santa Cruz was widened and improved. More people drove to the beach areas in their own automobiles, and the railroad carried fewer passengers. In 1940 the Southern Pacific received permission to give up this line to Santa Cruz. The movement was resumed to build the Lexington Dam, but the outbreak of World War II in 1941 stopped further plans.

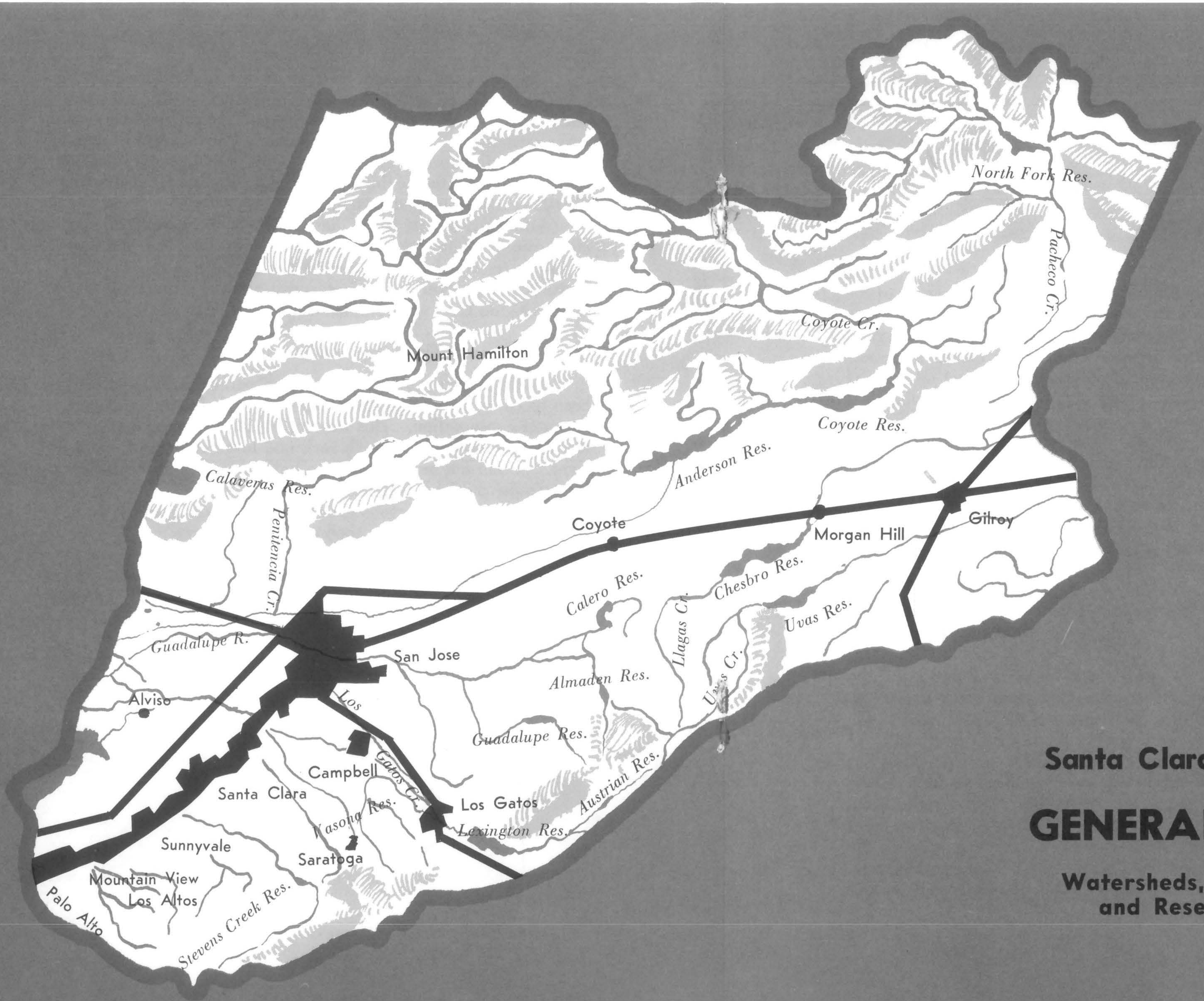
After the war, in 1947, the people voted a bond issue for this project. Before the dam could be built, the State highway had to be re-routed and a new section of road constructed. This process took another four years and it was not until 1952 that the Lexington Dam was completed.

The Leroy Anderson Dam

Another large dam, in the southern part of the district, had been recommended in 1930 by engineers in their original report on water conservation. This was to be built on the Coyote River to catch the flow of the north fork and lower main fork of the river. It had not been possible to build this dam in the 1930's because the public felt the project was too costly. Few people could predict the enormous growth which was to come later in the valley, and water needs then were not as heavy.

In 1948, however, the voters approved a bond issue to build the Leroy Anderson dam, named for the man who had given leadership to the water conservation program. This project, completed in 1950, provided the largest reservoir of all—with 75,000 acre-feet capacity. Anderson Lake has become a favorite recreation area for boating, swimming, fishing, water skiing, and all types of water sports.

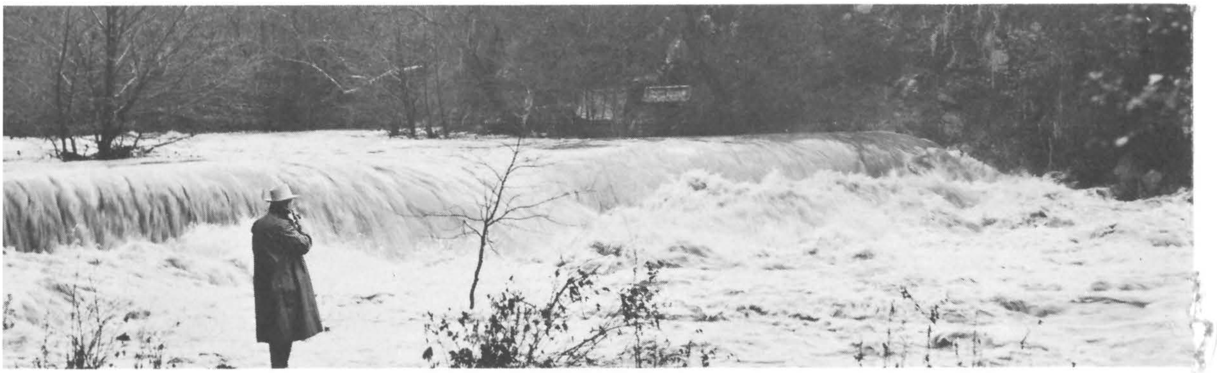
Leroy Anderson Reservoir



Santa Clara County

GENERAL MAP

Watersheds, Streams
and Reservoirs

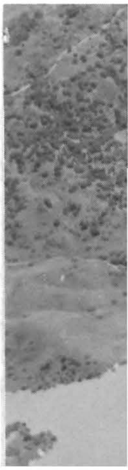


Storm Run-off in Uvas Creek

Thus far, our attention has been directed to the work of the Santa Clara Valley Water Conservation District in the area north of Morgan Hill. In the southern end of the valley beyond Morgan Hill, a number of years had passed before there was any great concern over water problems. Here most of the land continued to be dry-farmed and seasonal rains provided sufficient water for agriculture. Nevertheless, community leaders were aware that the changes which had affected the northern portion of the valley would soon take place in the south valley and the requirement for water would greatly increase. These men looked with great interest on the work of the Santa Clara Valley Water Conservation District and held informal meetings to discuss the possibility of a water conservation program for their area. Dr. Elmer J. Chesbro, Tom Hunter, Mark Smith, George Wolf, and C. D. Knepper were instrumental in laying the groundwork for the formation of the South Santa Clara Valley Conservation District which was approved by the voters in 1938.

Plans called for a program of dam construction on the Llagas and Uvas Creeks to capture and store water for stream bed percolation; however, the beginning of World War II delayed any consideration of this work for several years. In 1947 the South District proposed a bond issue to provide funds for these projects but the voters did not pass the measure. Meanwhile, the character of agriculture in the area was changing. Row crops, particularly strawberries, which required a great deal of water, were becoming more and more common and the underground water level was falling. In 1952 voters approved a bond issue for the construction of water conservation dams and pipelines.

Leroy



Chesbro Dam

The South District immediately began work on the construction of Chesbro Dam on the Llagas Creek on the west side of the valley. This dam, when completed in November, 1955, created a reservoir with a capacity of 7,500 acre-feet. Water captured during the rainy season was released down the Llagas Creek where it percolated in the natural stream channel. Additional use was made of the excellent percolation in the Llagas Creek stream channel. A four-mile pipeline was constructed from Uvas Creek to Llagas Creek and water was pumped from Uvas Creek to Llagas Creek for additional percolation.

Uvas Dam

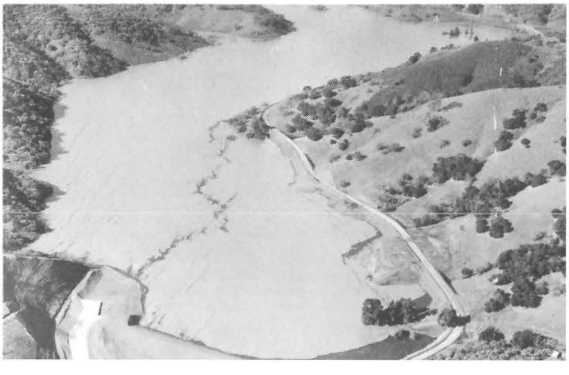
Two years after Chesbro Dam was constructed, the South District's Uvas Dam on Uvas Creek was completed. This dam created a reservoir which could store 10,000 acre-feet of water. The pipeline which previously connected Uvas Creek with Llagas Creek could now carry water from this reservoir to the Llagas stream channel for percolation. Releases from the Uvas Reservoir to the Uvas Creek channel also added to the South District's percolation program.

With these two dams and the connecting pipeline in operation, ground water levels in the critical areas of the South District showed immediate improvement. In the Rucker-San Martin locality, wells, which measured 134 feet to water in November 1955, reported 43 feet to water by the winter of 1959.

The water conservation districts in Santa Clara Valley could now store a combined total of 157,896 acre-feet of water in conservation reservoirs. The eight reservoirs of the Santa Clara Valley Water Conservation District can hold a total of 140,396 acre-feet of water while the two reservoirs of the South Santa Clara Valley Conservation District hold 17,500 acre-feet.

Uvas Reservoir

Chesbro Reservoir

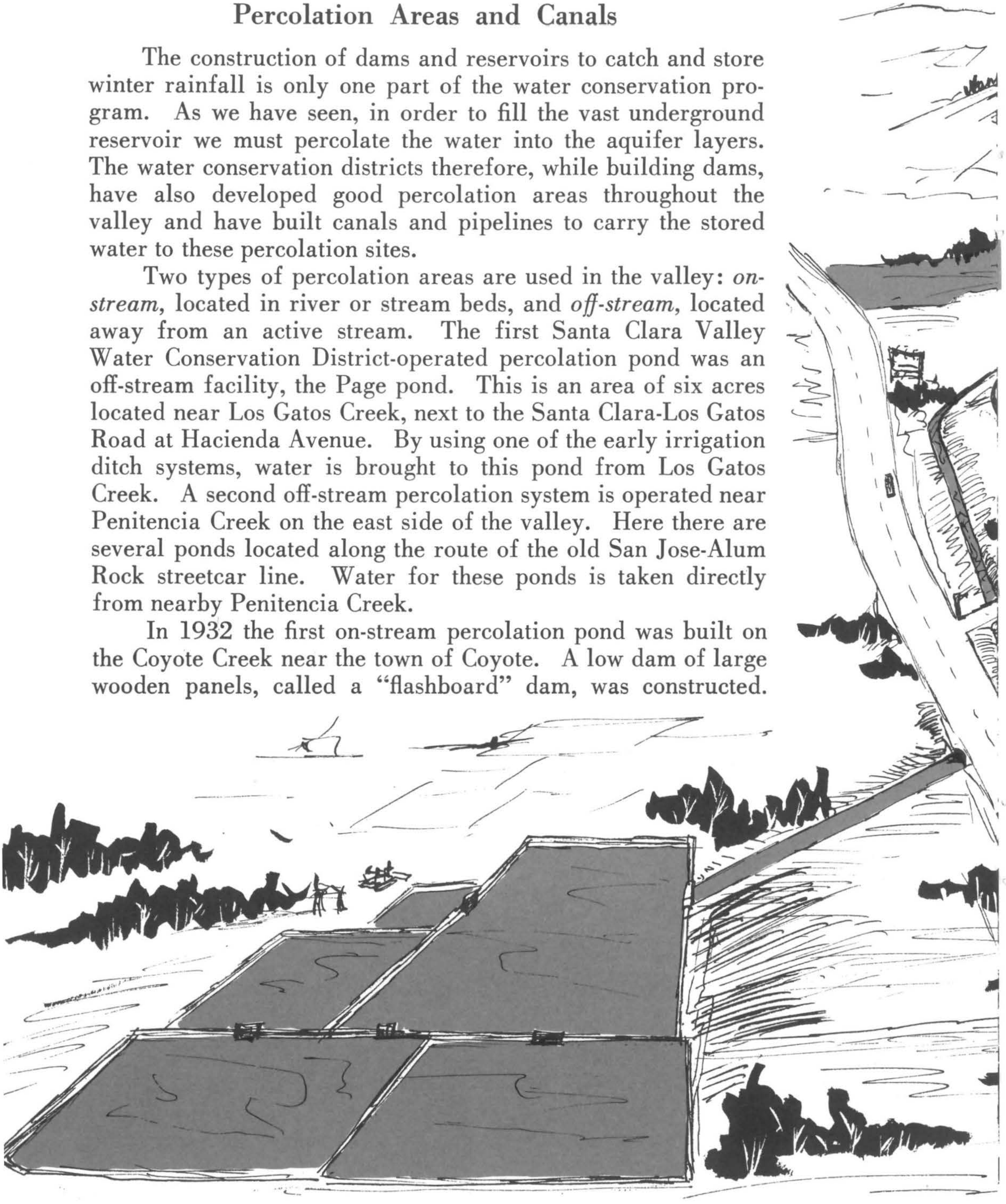


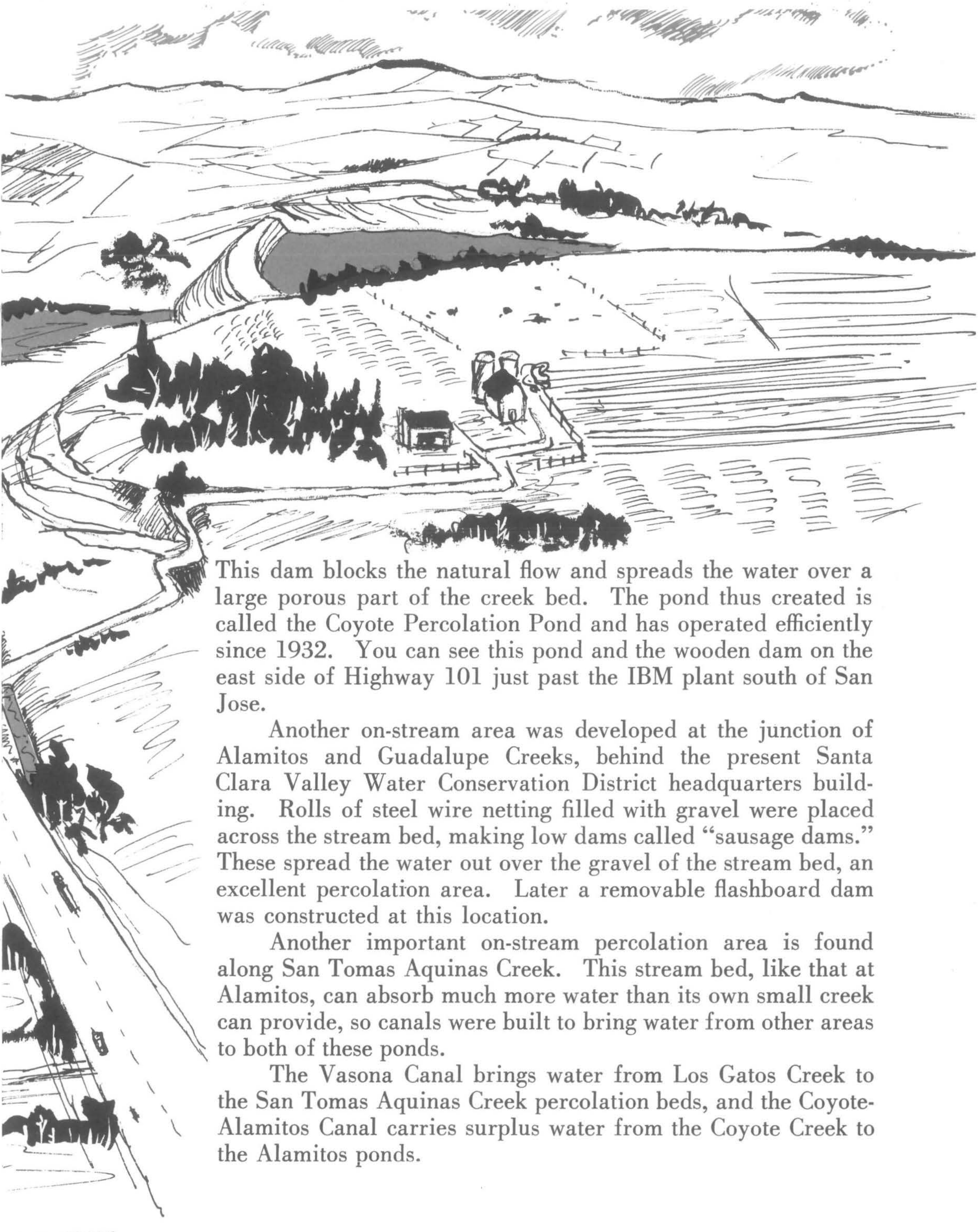
Percolation Areas and Canals

The construction of dams and reservoirs to catch and store winter rainfall is only one part of the water conservation program. As we have seen, in order to fill the vast underground reservoir we must percolate the water into the aquifer layers. The water conservation districts therefore, while building dams, have also developed good percolation areas throughout the valley and have built canals and pipelines to carry the stored water to these percolation sites.

Two types of percolation areas are used in the valley: *on-stream*, located in river or stream beds, and *off-stream*, located away from an active stream. The first Santa Clara Valley Water Conservation District-operated percolation pond was an off-stream facility, the Page pond. This is an area of six acres located near Los Gatos Creek, next to the Santa Clara-Los Gatos Road at Hacienda Avenue. By using one of the early irrigation ditch systems, water is brought to this pond from Los Gatos Creek. A second off-stream percolation system is operated near Penitencia Creek on the east side of the valley. Here there are several ponds located along the route of the old San Jose-Alum Rock streetcar line. Water for these ponds is taken directly from nearby Penitencia Creek.

In 1932 the first on-stream percolation pond was built on the Coyote Creek near the town of Coyote. A low dam of large wooden panels, called a "flashboard" dam, was constructed.





This dam blocks the natural flow and spreads the water over a large porous part of the creek bed. The pond thus created is called the Coyote Percolation Pond and has operated efficiently since 1932. You can see this pond and the wooden dam on the east side of Highway 101 just past the IBM plant south of San Jose.

Another on-stream area was developed at the junction of Alamitos and Guadalupe Creeks, behind the present Santa Clara Valley Water Conservation District headquarters building. Rolls of steel wire netting filled with gravel were placed across the stream bed, making low dams called "sausage dams." These spread the water out over the gravel of the stream bed, an excellent percolation area. Later a removable flashboard dam was constructed at this location.

Another important on-stream percolation area is found along San Tomas Aquinas Creek. This stream bed, like that at Alamitos, can absorb much more water than its own small creek can provide, so canals were built to bring water from other areas to both of these ponds.

The Vasona Canal brings water from Los Gatos Creek to the San Tomas Aquinas Creek percolation beds, and the Coyote-Alamitos Canal carries surplus water from the Coyote Creek to the Alamitos ponds.

Head of Evergreen Canal

The Almaden-Calero Canal has an unusual function. A dam on Calero Creek makes a large reservoir site which holds 9,213 acre-feet of water. The water drainage area here is very small, however, and Calero Creek itself could never fill this reservoir. About four miles away on Almaden Creek the water drainage area is very large, but because of the shape of the valley the Almaden dam provides only a small reservoir (holding 1,972 acre-feet of water). So a canal was built to carry water from the small basin with a large water supply, Almaden, to the large storage reservoir, Calero.

When the Leroy Anderson and Lexington dams were completed, the Santa Clara Valley Water Conservation District canal system was improved and expanded. The Coyote Canal was lengthened, in order to extend to the Evergreen area. A new Evergreen Canal was constructed. The Vasona Canal was extended with a pipeline to Calabazas Creek. The Coyote-Alamitos Canal was built to carry water from Coyote Creek to the Alamitos percolation ponds. Most of the older canals were widened and lined with concrete to make them better water carriers.

Early

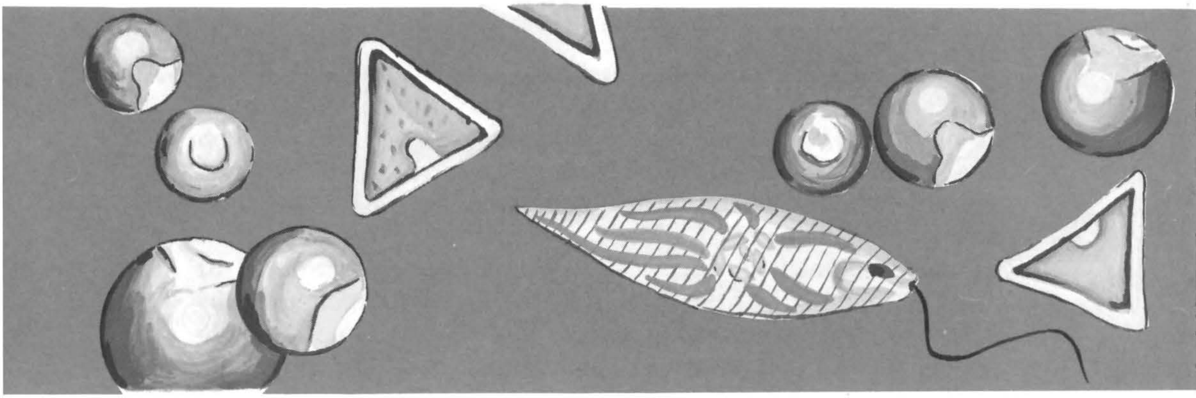
Our Bank Balance

The underground water reservoir may be thought of as a bank account. You have seen how water is added to that bank account by the reservoir and percolation system. But you can also see that simply adding more water will not solve the problem unless we make sure at the same time that we do not pump out more water than was added!

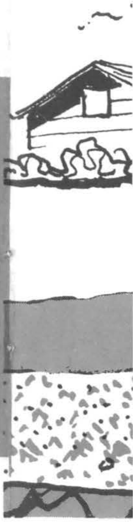
Several methods are used to cut down on the amount of water pumped out of the ground. One way is to make surface water from the canals and pipelines directly available to ranchers so that they will not have to pump out so much for irrigation. Another method is to keep some water flowing throughout the year in the streams below the dams so that farmers can pump from these streams rather than from deep wells. Water is released from the dams in carefully planned amounts to make this possible.

Some of our local communities obtain their water supply for home and industrial use from wells. It is planned to provide these communities with water from the conservation reservoirs in order to reduce the amount they must pump from underground. However, this water must be purified in some way before it can be used in homes and industry. The district and several communities are experimenting with various water treatment methods to make domestic use practical.

Irrigation



Some types of algae

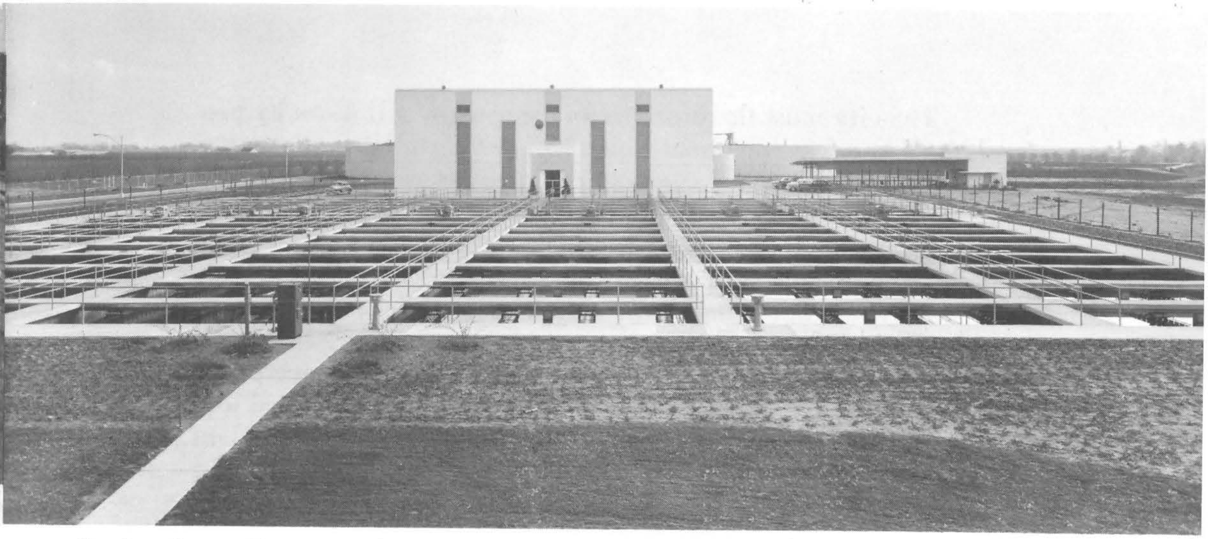


How

Using Water Twice

Have you ever thought about the amount of water we waste every day? The total number of gallons might amaze you! This waste water makes up the bulk of our sewage and it may surprise you to know that over 90 percent of our sewage water is perfectly clean! Just think about water used in your own home and you'll see why this is so. When you turn on the faucet and let the water run for a minute or so, good clean water is wasting down the drain to the sewer line. When you adjust the shower temperature before stepping in, clean water is running down the drain; rinse water for clothes is practically clean; there are many other examples of domestic waste of good water.

There are also similar water waste conditions in industry. In the cannery, dozens of shower-heads pour hundreds of gallons of cold, clean water over hot cans of preserved food to cool them. A steady flow of water is used as a transmission system to carry a relatively small amount of waste to the sewer lines. In Santa Clara Valley more than 30,000 acre-feet of waste water passes through the San Jose Sewage Treatment plant each year. The Palo Alto treatment plant processes 8,400 acre-feet of waste annually while plants at Sunnyvale, Mountain View, Gilroy, Milpitas, and Morgan Hill account for a total of 12,300 acre-feet of waste water in sewage treatment. The total amount of waste-water processed every year in this valley is impressive and is constantly increasing.



San Jose Sewage Treatment Works

Engineers believe that waste water should be considered as "dirty" water which can be cleaned and used again. They point out that a dirty shirt or a soiled dress isn't thrown away—it is washed or dry cleaned. It is also possible to have a "cleaning" program for "dirty" water! Using this "cleaned" or reclaimed water in industry and agriculture would greatly reduce the amount of water now being pumped from our underground supply.

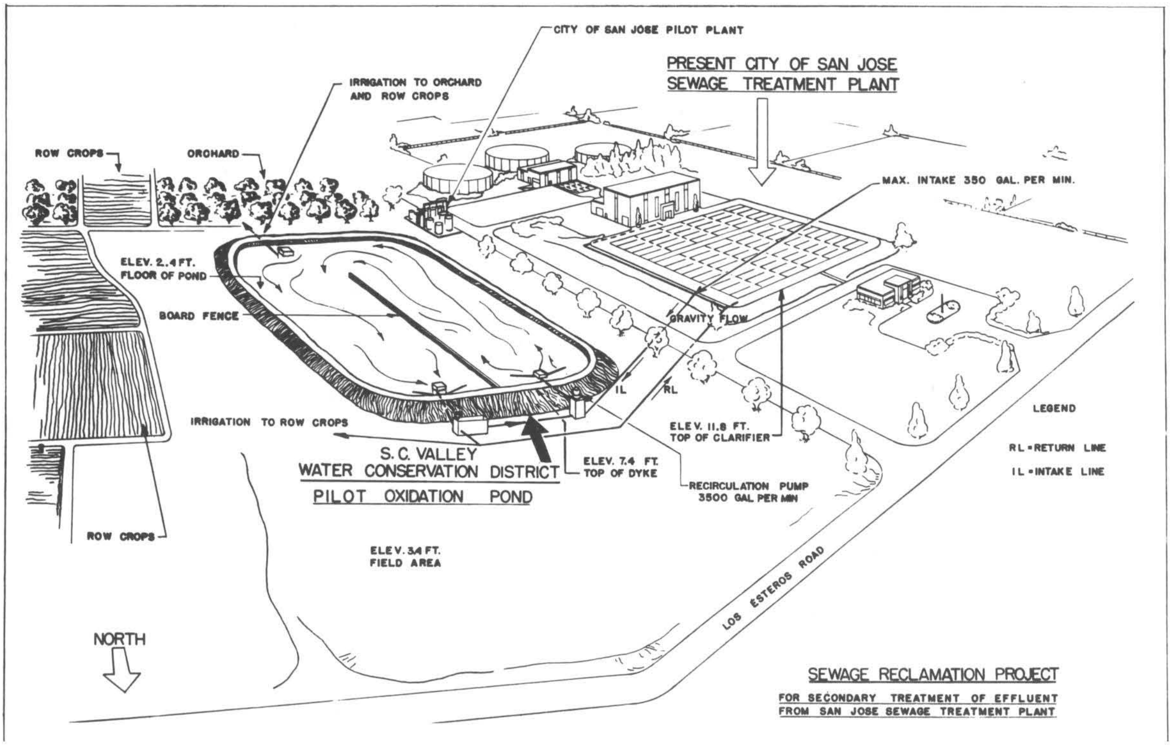
Today, more than twenty California communities have programs to re-use water which was formerly wasted. Golden Gate Park in San Francisco is irrigated by water recovered from sewage waste. Much irrigation water in Concord and Santa Rosa comes from their sewage treatment plants. In extremely dry sections of the Southwest, reclaimed water is used both for agriculture and domestic purposes.

The Santa Clara Valley Water Conservation District and the City of San Jose are cooperating in a program to save the waste water which goes through the San Jose sewage treatment plant. This plant now gives *primary* treatment to the sewage before pouring it into the bay. This treatment removes the solids from the sewage but leaves some organic matter in the water. The organic matter uses up oxygen from the salt water of the bay, thereby reducing the amount of oxygen available for fish life.

The city must therefore clean the sewage still more by providing *secondary* treatment which will destroy all organic matter in the waste. Since waste water which has received both primary and secondary treatment is good, usable water, the Santa Clara Valley Water Conservation District has a definite interest in the new salvage program.

In 1958 this conservation district established an experimental secondary treatment plant for waste water, using the oxidation pond method, next to the San Jose treatment plant. After the solids are removed from the sewage, it is pumped into an oxidation pond. A growth of *algae* (a primitive type of plant life) is maintained in the pond. The algae absorb a great deal of oxygen from the air and release this oxygen into the water. The oxygen is used to kill or make ineffective any organic matter in the waste water. This process, known as "oxidation," is actually a slow burning which destroys all remaining organic matter.

Operation of this experimental oxidation pond during 1958 demonstrated that this form of secondary treatment was effective in reclaiming sewage water for re-use.


CITY OF SAN JOSE PILOT PLANT
PRESENT CITY OF SAN JOSE SEWAGE TREATMENT PLANT
IRRIGATION TO ORCHARD AND ROW CROPS
ROW CROPS
ORCHARD
MAX. INTAKE 350 GAL. PER MIN.
ELEV. 2.4 FT. FLOOR OF POND
BOARD FENCE
GRAVITY FLOW
IL
RL
IRRIGATION TO ROW CROPS
ELEV. 11.8 FT. TOP OF CLARIFIER
LEGEND
RL = RETURN LINE
IL = INTAKE LINE
S. C. VALLEY WATER CONSERVATION DISTRICT
PILOT OXIDATION POND
ELEV. 7.4 FT. TOP OF DYKE
RECIRCULATION PUMP 3500 GAL PER MIN
ROW CROPS
ELEV. 3.4 FT. FIELD AREA
LOS ESTEROS ROAD
NORTH

SEWAGE RECLAMATION PROJECT

FOR SECONDARY TREATMENT OF EFFLUENT FROM SAN JOSE SEWAGE TREATMENT PLANT

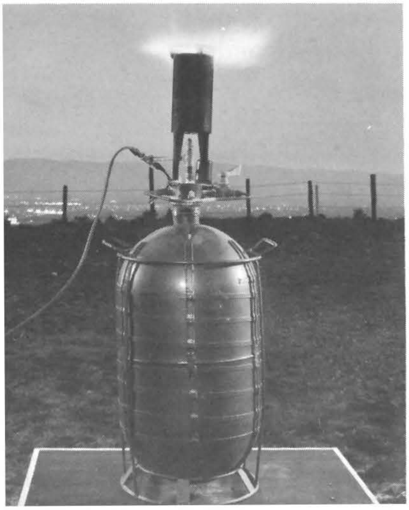
Storm Clouds Over the Valley

Controlling the Weather

Weather is the key to any water conservation program, because rain is the primary source of fresh water. Storage facilities are necessary to catch seasonal run-off before it flows into the ocean, but even with such facilities, a number of dry years combined with an increasing use of water can have a harmful effect on the underground water level. No matter how efficient the system of reservoirs may be, the entire conservation program depends on normal seasonal rainfall.

Because man's existence is so dependent on weather, he has attempted to control it. Indians in the Southwest, through ceremonial dances, call on their rain gods for assistance. The old "rainmaker" was a fixture in the midwest for many years. He traveled through the farm areas and offered his services to communities threatened with crop failure because of drought conditions.

Today we apply our scientific knowledge of weather conditions to modify weather to benefit man. Weather modification contractors have been conducting cloud seeding operations in Santa Clara County since the winter of 1951-52. The Santa Clara County Board of Supervisors pioneered this program and financed its operation until June 1958. The two water conservation districts in the County now sponsor this rain-increasing program.



Contrary to popular notion, this is not a "rain-making" program. The goal is to obtain the maximum rainfall during storm conditions. Existing weather conditions are watched very closely and radar is used to track approaching storms. When rain clouds appear, and natural conditions exist which favor rainfall, the cloud seeders work to increase the expected natural rainfall. Their equipment introduces into the atmosphere additional *nuclei* or tiny particles around which water vapor forms to produce more raindrops.

These nuclei are formed by heating a chemical solution of silver iodide to high temperatures, from 1800 to 2000 degrees Fahrenheit, in a generator which looks much like a small stove. The heated silver iodide escapes from the generator in much the same way that steam escapes from the spout of a heated tea kettle.

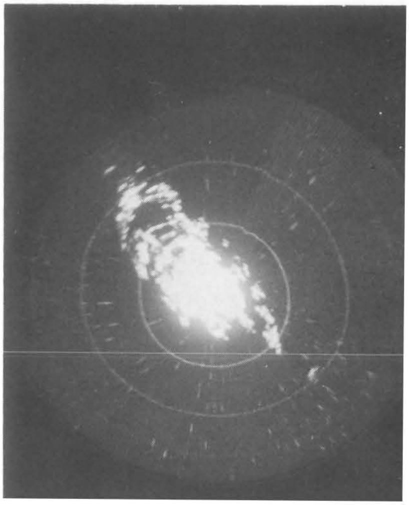
This silver iodide vapor is introduced into the natural rainclouds by two methods. In one method, the generators are located on the ground, usually around the edge of the large area which is to be served by the cloud seeding activity. They are placed into operation when the rain clouds are in the locality and the silver iodide ascends naturally from the operating generators. In the other method, a generator is mounted on an airplane which flies through the rain

Weather Teletype
Radar Antenna
Ground Generator

Arte

clouds during the storms. These aircraft are usually high-performance combat-type planes, which have been designed for flight during the most unfavorable weather conditions.

The results of the rain increasing program are determined by using a comparison system to measure the effect of cloud-seeding on rainfall. First, the official government rainfall records for the proposed target area are checked over a ten year period when no cloud seeding took place. Rainfall records of surrounding areas are also checked for the same ten year period. A ratio is then established between the rainfall in the two areas. For example, we may learn that over a long period the rainfall in Area A is usually half the rainfall in nearby Area B. When it rains 5 inches in Area A, it usually rains 10 inches in Area B. Now, suppose that Area B is seeded during the winter and we wish to measure the results of the seeding. We take the rainfall in Area A for that winter period and multiply it by 2 to find the expected normal rainfall in the cloud-seeding target area, B. Then we compare the actual rainfall in the target area, B, with the expected normal rainfall. The difference in rainfall is attributed to the cloud-seeding program.

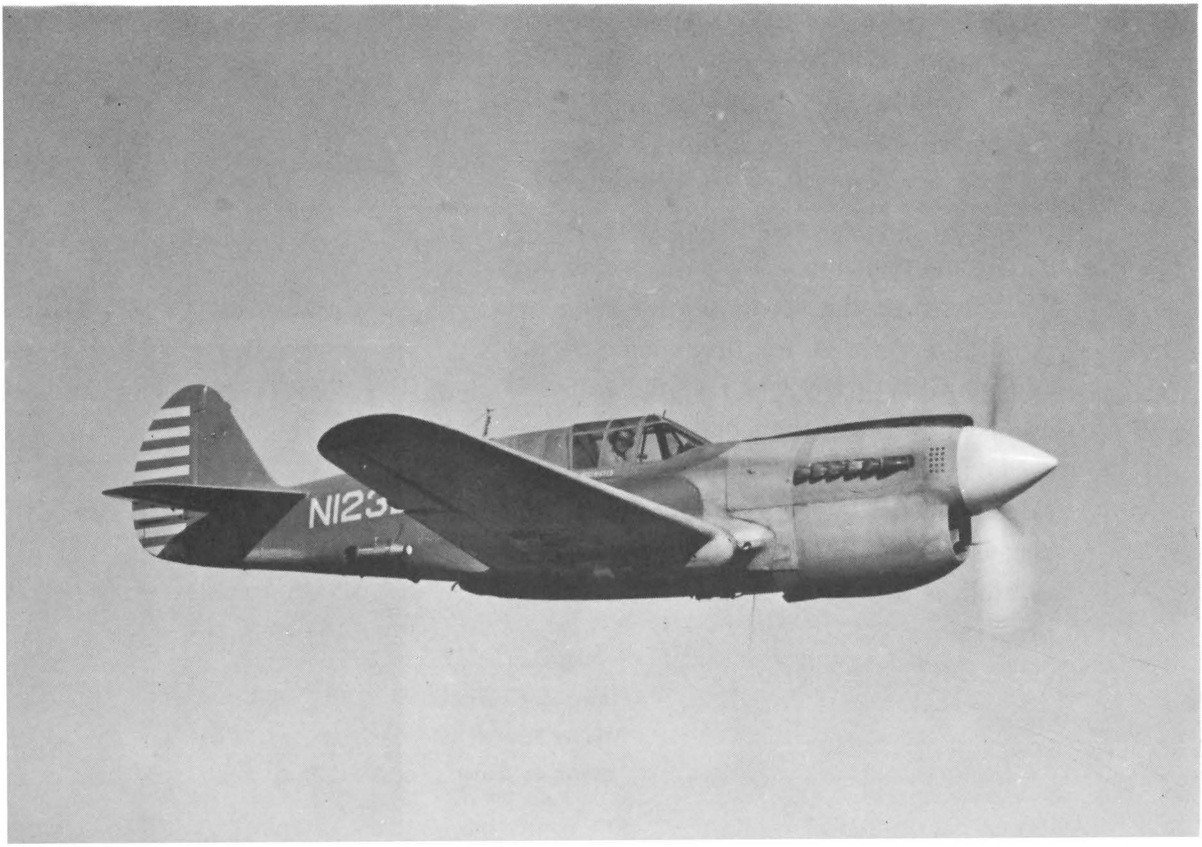


Aircraft Generator
Radar Screen
Storm on Radar

How important is rain-increasing to the water conservation program? An increase of *only one inch* of rain over the entire Santa Clara County provides an additional 70,000 acre-feet of water. If we use only two-thirds of this rainfall, we improve our water situation by more than 46,000 acre feet. A rainfall of 18 inches in San Jose during a year will fill all of the water conservation district reservoirs. Since 1950 this has happened during three winters, and each of these were cloud seeding years. The most recent results show an increase of 5 inches of rainfall during 1955-56, 3 inches during 1957-58, and 3½ inches during the 1958-59 winter.

The National Advisory Committee on Weather Control, appointed by President Eisenhower, has studied weather modification operations in great detail. The final report of this committee, submitted December 31, 1957, stated that seeding winter storm clouds in areas such as ours will result in a high probability of a substantial increase in rainfall.

Cloud-seeding Aircraft



South Fi

Planning for the Future

By the early 1950's the growth of the Santa Clara Valley and its thirst for water were outstripping attempts to keep the underground water bank balanced. The original area of the Santa Clara Valley Water Conservation District had expanded with the addition in 1953 of 4000 acres of land in the eastern foothills, known as the Evergreen area. In 1954, a 14,000 acre area, extending from Coyote to the south limits of Morgan Hill, became a part of the Santa Clara Valley Water Conservation District. Beyond Morgan Hill the South Santa Clara Valley Water Conservation District had been organized to meet the conservation needs of the southern end of the valley. Despite all efforts of these conservation districts to capture winter run-off for percolation into the underground, water usage was exceeding the annual supply that could be retained.

An extensive program was planned to improve and expand the conservation system. Canals would be improved to increase their water-carrying capacity. New percolation areas would be purchased and developed in order to receive the additional water. Pipelines would be built to carry water from storage sites through the growing residential tracts to stream beds for percolation. In March, 1957 voters passed a bond measure for the Santa Clara Valley Water Conservation District to finance these improvements and purchase new percolation areas. Work began immediately on the program.

Predictions of increased population indicate that eventually even this program will be insufficient and water will have to be imported from some outside source. Our water needs and problems are becoming more and more related to the work of the State and the Federal government to meet the growing needs of all the west. In our local area we must continue the program of careful study, planning and action if we are to conserve and use wisely our local resources. At the same time we must prepare for the day when we will also use imported water, making certain that our distribution systems will be complete and ready for service when outside water comes.

GLOSSARY

Acre-foot	A unit of water measure used by water engineers; the amount of water required to cover one level acre to a depth of 1 foot.
Algae	Plants of a very simple form widely distributed in fresh and salt water and in moist land. They include seaweeds and pond scums.
Aqueduct	A water-carrying pipeline or canal which supplies water to a community from a distance.
Aquifer	Underground layers of sand and gravel which can hold water in the spaces between the particles of sand and gravel.
Artesian well	A well, bored down to a water-bearing strata that will flow without pumping because the water pressure is so great as to force the water out at the surface.
Bureau of Reclamation	A Federal agency which works to bring waste land to use by developing water projects.
Divert	To turn aside in a new course or direction.
Ground water	Water from below the surface of the ground.
Ground water level	Distance from the surface to the underground water.
Impervious	Will not permit passage into or through.
Nucleus, nuclei (plural)	The central part or 'kernel' of any mass.
Propane	A gas which burns with great heat.
Run-off	That part of the rainfall which is not absorbed by the soil but which is drained off in streams.
Strata	Natural or artificial layers.
Watershed	The whole region from which a stream receives its supply of water.

Inside Photos: San Jose Mercury-News, Santa Clara Valley Water Conservation District, Weather Modification Company, Herbert C. Jones.

Outside Cover: Calero Reservoir by Lester G. Smith.

SANTA CLARA VALLEY WATER CONSERVATION DISTRICT
AVERAGE DEPTH TO WATER AT END OF IRRIGATION SEASON